FINAL REPORT

Project title: Survey of Florida's Wood Stork (*Mycteria americana*) nesting colonies, 2004

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INTRODUCTION

The United States breeding population of Wood Storks (*Mycteria americana*), which presently nests in Florida, Georgia, and South Carolina, has been listed as Endangered by the U. S. Fish and Wildlife Service (USFWS) since 1984. This action resulted from a striking decline from 15,000-20,000 to 4,500-5,700 pairs (65-75%) by the late 1970s (Ogden et al.1987, USFWS 1996, Coulter et al. 1999) . This decline was accompanied by a major shift in breeding abundance from southern Florida to a much more dispersed distribution northward through peninsular Florida and into coastal Georgia and South Carolina. The listing process cited several likely causes of these population changes, primarily the loss of feeding habitat and large-scale manipulations of surface-water levels in south Florida (USFWS 1996).

The revised USFWS (1996) recovery plan for the Wood Stork states the following criteria for downlisting of the U.S. population. To move from Endangered to Threatened status, surveys must document an average of 6,000 nesting pairs per year and productivity of 1.5 fledged young per nest per year over a three-year period. Delisting the species requires a five-year average of 10,000 nesting pairs, productivity of 1.5 fledged young per nest over the same period, and a minimum of 2,500 successfully nesting pairs in the Everglades and Big Cypress Swamp systems of south Florida. The recovery plan called for multi-state aerial surveys and ground estimates of productivity to evaluate the species' status with regard to the recovery objectives.

In the summers of 2002, 2003, and 2004, Avian Research and Conservation Institute (ARCI) administered the Florida component of the multi-state surveys to estimate numbers of nesting pairs of Wood Storks. In this report, we present the 2004 data, which consist of our aerial survey results and those of aerial and ground surveys conducted or compiled by Sonny Bass (National Park Service), Bill Brooks (USFWS), Rebecca Hylton (University of Florida), Jason Lauritsen (National Audubon Society, Corkscrew Swamp Sanctuary), Ann Moore (St. Johns River Water Management District), Ann Paul (National Audubon Society), Rich Paul (National Audubon Society), Jim Rodgers (Florida Fish and Wildlife Conservation Commission), and Ken Tracey (Pasco County Audubon).

METHODS

ARCI's field methods in Florida consisted of two types of aerial surveys: counts of Wood Stork nests at known colonies; and transect plots over apparently suitable habitat in which nesting colonies have not been previously reported (the plots also contained known, active colonies). Colony locations and the previous annual estimates of the numbers of nests were supplied by various observers and compiled by the U.S. Fish and Wildlife Service. Some small colonies that had been active infrequently since 1991 were omitted from our surveys so that we could devote our flight time to the sites most likely to be active in 2004.

The colony counts contributed by others were made from the ground or from a helicopter. All of the cooperating observers were experienced at counting Wood Stork nests. Ground and helicopter counts probably were more accurate than the counts we made from fixed-wing aircraft. In all cases where a colony was counted by both ARCI and a ground- or helicopter-based observer, the counts from the latter source are presented in Table 1.

Our aerial survey methods were similar to those reported by Rodgers (1995). We used a Cessna 172 single-engine fixed-wing aircraft for both types of surveys. Eight flights were conducted from 18 May to 14 June 2004. For the colony counts, the coordinates of the targeted colonies were programmed prior to take-off into a handheld GPS receiver with an external, windshield-mounted antenna (Garmin GPS 12-XL). We approached each colony at an altitude of 300 m above ground level and descended to 150-200 m when close to the site. If no nests were observed, we declared the site inactive and proceeded to the next nearest colony location.

If a colony was active, storks usually were visible somewhere in the vicinity (flying, perching, or attending nests) as we approached the location. If not, we flew to the fix and then gradually circled outward, scanning for birds within an area of about 10 sq km surrounding the putative colony location. At each active colony, two observers counted the storks and estimated the number of occupied nests (i.e., with adults, eggs, or young).

As we have pointed out previously, considerable underestimates of the number of Wood Stork nests can result from shifts in colony locations between years. To determine whether aerial surveys could be used to discover previously unobserved nesting colonies, we flew three rectangular search patterns (plots A, B, and C) in central Florida in May and June 2003,and we repeated the surveys at two of these plots (A and C) in 2004. The plots were positioned to include as much suitable nesting habitat as possible. Each plot was 50 km long (aligned east/west) and 21 km wide. We flew five (plot A on 20 May) or six (plot C on 14 June) parallel transects spaced 3.0 km (1.85 statute miles, 1.60 nautical miles) apart at an altitude of 300 m above ground level and an airspeed of about 160 km/h. Plot A straddled the Pasco/Hillsborough County line and included the northeastern corner of Pinellas County. Plot C included parts of Hillsborough and Polk counties (south of Lakeland). The transect surveys were flown between the hours of 08:30 and 15:45. Two observers seated on opposite sides of the airplane directed their continuous scan 90 degrees to the transect for a distance of 1.5 km from the transect (halfway to the adjacent transect). We diverted from the transect to inspect any white birds seen on the ground within that distance (and used GPS fixes to resume course along the transect after each diversion). If nesting Wood Storks were present, we circled the colony to count the nests as we did during the regular colony counts. If complete visual coverage is assumed, we searched a total of 1,640 sq km. It was unlikely, however, that Wood Storks were uniformly detectable over the entire 1.5 km lateral distance on either side of each transect.

RESULTS AND DISCUSSION

All count data are presented in Table 1.

Florida observers counted 5,214 pairs of nesting Wood Storks in 58 active colonies in 2004. Based on the upper limits of all annual estimates, 2004 had 0.7 to 7.1 times as many nests as estimated from 1990 to 2003. The 2004 count was 27% lower than the median estimate for 2002 and 19% lower than that for 2003.

Nest initiations were late but numbers were high in the large south Florida colonies in 2004. Beginning in March, however, increasing rainfall and surface water apparently caused abandonment of most of the active nests over much of the region (e.g., Tamiami West, Jetport, Crossover, and Corkscrew). The exceptions were the colonies in the southern Everglades (Rodgers River Bay, Paurotis Pond, and Cuthbert Lake), which had good nest success. In contrast, surface water conditions in central and northern Florida apparently were favorable for stork nesting.

In 2003, a total of about 6,400 nests were distributed over 49 occupied colonies, a per-colony average of about 130 nests. The 58 active colonies observed in 2004 contained 5,214 nests, an average of 90 nests per colony. This between-year difference in total number and distribution of nests probably reflects the poorer nesting success of the large south Florida colonies in 2004 and the larger component of nesting activity in central and northern Florida, where most colonies are smaller.

Of the 91 colonies observed, 27 (30%) were counted by ground observers. ARCI surveyed 74 colonies, but 10 of these also were counted from the ground, leaving 64 ARCI counts (70%) to be used in the total estimate. As Rodgers et al. (1995) warned, estimates of Wood Stork nesting effort based on aerial surveys could have very large confidence intervals. Most of this variability results from the cumulative errors associated with counts of large, mixed-species colonies with high proportions of other white-plumaged species; the most common error is to confuse Wood Storks with Great Egrets, usually resulting in an over-estimate of storks. The 2004 counts provided a modest opportunity for a tentative evaluation of the accuracy of the aerial counts. Ten of the colonies counted from the air by ARCI also were counted from the ground by other observers, all experienced at estimating numbers of wading bird nests by species. The ground observers counted a total of 1,369 Wood Stork nests in the 10 colonies; ARCI's aerial counts totaled 1,480. The 8.1% higher count by ARCI is most likely attributable to the false identification of Great Egret nests as Wood Stork nests. It also is possible, however, that limited visibility and mobility for the ground observers resulted in a slight underestimation of nests in the colonies they surveyed. Thus, the actual number of nests may lie somewhere between the two types of estimates. The USFWS (1996) has taken the position that, even with the presumed error, aerial surveys are the most cost-effective long-term method for estimating Wood Stork population trends. Based on our limited comparison of ground and aerial counts, this position is justified.

Eleven new colonies were detected in 2004 with a mean of 36 (±23 SD, range 4-65) nests per colony. The 400 nests in these 11 colonies represent 7.7% of the 5,214 nests found in 2004. This is particularly noteworthy considering that most of these colonies were found opportunistically, not as a result of a large-scale systematic search. At least some of these colonies may have consisted of pairs relocating or spilling over from nearby known colonies. In any case, this result is interesting with regard to nesting biology and its implications for monitoring surveys.

Considerable underestimates can result from shifts in colony locations between years if the birds move far enough to evade detection under the present search protocol, which focuses only, and rather narrowly, on previously used sites. The results of our aerial transect surveys support this contention. We found two previously unidentified colonies on each of the two plots surveyed in 2004, and two colonies newly discovered in plot A in 2003 were not detected in 2004. If funding would permit coverage of more transect plots and more closely spaced transects, and if the surveys could be flown earlier in the season, it is likely that more of these previously undetected small to medium-sized colonies would be found. As we have discussed, we are considering a third survey of one of the transect plots and the addition of several longer, coast-to-coast transects in 2005.

We also believe that there is likely to be considerable underestimation as a result of counting each colony at only a single point in time, because nests that fail earlier or start later than the survey date will not be counted. Modeling suggests that this could result in undercounts of 20–50% in the case of birds with a long nesting season and asynchronous nesting, such as Wood Storks. We suggest that effort should be devoted to finding affordable ways to improve the accuracy of our statewide estimates of Wood Stork nesting effort.

ACKNOWLEDGMENTS

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TABLE 1.

Locations of Wood Stork breeding colonies in Florida in 2003 and 2004 and the numbers of active nests counted in each from the ground and air. Counts were made by ARCI staff (e.g., "2004 ARCI") and cooperators (e.g., "2004 other"), who are cited. A blank cell indicates that the colony was not surveyed; a 0 indicates that the colony was surveyed but no Wood Stork nests were observed.

Table 1. Locations of Wood Stork breeding colonies in Florida in 2003 and 2004 and the numbers of active nests counted from the ground and air.

Name	County	Latitude	Longitude	2003 ARCI	2003 Other	Date	Obs	2004 ARCI	2004 Other	Observer	Use for total
CR 452	Brevard	28.363	80.817	170		5/28/2004	KM	140			140
US 192 W	Brevard	28.088	80.850	45		5/28/2004	KM	60			60
US 192 E	Brevard	28.100	80.817	0		5/28/2004	KM	0			0
Lake Washington	Brevard	28.107	80.782	350		5/28/2004	KM	320			320
SW Lake Washington	Brevard	28.117	80.767	0		5/28/2004	KM	0			0
Valkaria	Brevard	27.968	80.537	30		5/28/2004	KM	0			0
	Brevard	27.977	80.542	0		5/28/2004	KM	20			20
Grant Farm Island	Brevard	27.917	80.515			5/28/2004	KM	0			0
	Brevard	27.893	80.502	10		5/28/2004	KM	0			0
2B Melaleuca	Broward	26.163	80.345	0		6/2/2004	KM, GZ	0			0
	Charlotte	26.978	81.975	35		5/25/2004	KM	50			50
Morganton	Charlotte	27.017	81.983	60		5/25/2004	KM	120			120
Big Cypress*	Collier	26.047	81.120	0		6/1/2004	KM, GZ	0			0
	Collier	26.247	81.442	0		6/1/2004	KM, GZ	0			0
	Collier	26.460	81.317	0		6/1/2004	KM, GZ	0			0
Corkscrew**	Collier	26.367	81.615	420	1000	6/1/2004	KM, GZ	235			235
	Collier	26.387	81.615			6/1/2004	KM, GZ	30			30
Sadie Cypress	Collier	26.400	81.300	0		6/1/2004	KM, GZ	0			0
Falling Rock	Columbia	30.250	82.667			5/18/2004	KM	0			0
	Columbia	30.177	82.723	0		5/18/2004	KM	65			65
	Columbia	30.162	82.637	0		5/18/2004	KM	0			0
Paurotis Pond, ENP	Dade	25.275	80.802	0	130				195	S. Bass	195
Cuthbert, ENP	Dade	25.202	80.772	0	75				75	S. Bass	75
Tamiami Trail West	Dade	25.760	80.545	75	350				35	P. Frederick	35
Jetport	Dade	25.867	80.253		375				0	P. Frederick	0
L-28 Crossover	Dade	25.940	80.831	35	40				150	P. Frederick	150
Pumpkin Hill Creek	Duval	30.472	81.505		120	6/4/2004	KM	0	0		0
Jacksonville Zoo	Duval	30.407	81.642		84				87	J. Rodgers	87
Dee Dot Ranch	Duval	30.222	81.447	150	225-250	6/4/2004	KM	155	128	J. Rodgers	128
Lake Disston	Flagler				0				26	A. Moore	26
El Claire Ranch	Hardee	27.500	81.617	70		5/25/2004	KM	150			150
Weeki Wachee	Hernando	28.517	82.600	0	29	5/20/2004	KM, GZ	0			0
	Hernando	28.625	82.395	0		5/20/2004	KM, GZ	0			0
Croom	Hernando	28.537	82.207	340	325-350	5/20/2004	KM, GZ	180	189	J. Rodgers	189

	Hillsborough	27.667	82.417	0		5/25/2004	KM	10			10
	Hillsborough	27.848	82.417			5/25/2004	KM	0			0
	Hillsborough	28.100	82.333			5/20/2004	KM, GZ	0			0
Cypress Creek	Hillsborough	28.163	82.383	0	175	5/20/2004	KM, GZ	0	59	J. Rodgers	59
East Lake	Hillsborough			27	R. & A. Paul				36	R and A Paul	36
	Hillsborough	27.877	82.105	0		5/25/2004	KM	0			0
Trout Creek	Hillsborough	28.144	82.351	15		5/20/2004		0			0
Pelican Island NWR	Indian River	27.797	80.433		120	5/28/2004	KM	150			150
	Jefferson	30.573	83.763			5/18/2004	KM	0			0
Lake Yale	Lake	28.920	81.688	0		5/28/2004	KM	0			0
Mud Lake	Lake	28.967	81.383		28	5/28/2004	KM	0			0
	Lee	26.687	81.832	45		6/1/2004	KM, GZ	240			240
Ochlocknee River	Leon	30.543	84.380	75	125-150	5/18/2004	KM	140			140
Chaires	Leon	30.433	84.130	0	300-350	5/18/2004	KM	320	282	J. Rodgers	282
	Madison	30.610	83.608	0		5/18/2004	KM	0			0
Ayers Point (Dot-Dash)	Manatee	27.500	82.528		247	5/25/2004	KM	250	241	R and A Paul	241
Sewel Point	Martin	27.192	80.188	45		6/2/2004	KM, GZ	150			150
Rodgers Rvr Bay ENP	Monroe	25.555	81.072	0	130	6/1/2004	KM, GZ	120	150	S. Bass	150
	Orange	28.380	81.185	120		5/28/2004	KM	160			160
	Orange	28.567	81.233			5/28/2004	KM	0			0
Lake Russell	Osceola	28.125	81.417		65	5/25/2004	KM	60	63	J. Rodgers	63
SWA Catchment	Palm Beach	26.768	80.148		140	6/2/2004	KM	75			75
	Palm Beach	26.553	80.250	0		6/2/2004	KM	40			40
Devil's Creek	Pasco	28.417	82.083		14	5/20/2004	KM, GZ	8			8
Little Gator Creek	Pasco	28.300	82.067		225	5/20/2004	KM, GZ	170	160	J. Rodgers	160
Greenbrooke	Pasco	28.218	82.677		181	5/20/2004	KM, GZ	35			35
New Port Richey	Pasco	28.233	82.727		225				178	J. Rodgers	178
Seven Springs	Pasco	28.213	82.677		39	5/20/2004	KM, GZ	38			38
Saddlebrook Resort	Pasco	28.233	82.333			5/20/2004	KM, GZ	0			0
Anclote River	Pasco			6		5/20/2004	KM, GZ	9			9
Odessa	Pasco	28.202	82.564	30		5/20/2004	KM, GZ	0			0
	Polk	27.900	81.967	0		5/25/2004	KM	0			0
	Polk	27.910	81.950	25		5/25/2004	KM	45			45
	Polk	28.002	81.935	45		5/25/2004	KM	50			50
	Polk	27.970	81.813	0		5/25/2004	KM	0			0
	Polk	27.900	81.450	0		5/25/2004	KM	0			0
Lake Rosalie	Polk	27.900	81.417	25	125	5/25/2004	KM	75	46	J. Rodgers	46

	Polk	28.067	81.367			5/25/2004	KM	0			0
Reedy Creek	Polk	28.083	81.383	4		5/25/2004	KM	0			0
Lone Palm	Polk	28.050	82.008		175	5/25/2004	KM	135	82	J. Rodgers	82
N Port Charlotte	Sarasota	27.033	82.277	0							
	Sarasota	27.150	82.475	15		5/25/2004	KM	0			0
Blackburn Bay	Sarasota			67	R. & A. Paul				62	J. Rodgers	62
Rayonnier	St. Johns	29.730	81.290		18	5/28/2004	KM	15	28	J. Rodgers	28
St. Aug Alligator Farm	St. Johns								32	J. Rodgers	32
	St. Lucie	27.292	80.620	0		6/2/2004	KM, GZ	100			100
N. Fork St. Lucie Rvr	St. Lucie	27.262	80.317	35		6/2/2004	KM, GZ	70			70
New in 2004											
Transect plot A	Pasco	28.164	82.398			5.20/04	KM, GZ	40			40
Transect plot A	Pasco	28.226	82.331			5.20/04	KM, GZ	17			17
Tranxect plot C	Hillsborough	27.776	82.175			6/14/2004	KM, GZ	38			38
Transect plot C	Polk	27.919	81.995			6/14/2004	KM, GZ	15			15
Loxahatchee	Palm Beach	26.52	80.265			6/2/2004	KM, GZ	65			65
ENP new col 3	Monroe	25.553	80.842						4	S. Bass	4
WCA 3B Mud East	Dade	25.801	80.490						82	P. Frederick	82
South Jetport	Dade	25.808	80.865						29	P. Frederick	29
Ochlocknee South	Leon	30.509	84.357						46	J. Rodgers	46
Heron Island	Pasco	28.209	82.677						18	J. Rodgers	18
Cross Creek	Hillsborough	28.142	82.352						46	J. Rodgers	46
											5214